

## **REMARKS**

Upon entry of this amendment, claims 1-9 and 11-20 are all the claims pending in the application. Claim 10 has been canceled by this amendment.

Applicant notes that a number of editorial amendments have been made to the specification and abstract for grammatical and general readability purposes. Due to the number of changes made, a substitute specification and abstract are submitted herewith. No new matter has been added. Also enclosed is a marked-up copy of the original specification and abstract showing the changes incorporated into the substitute specification and abstract.

### **I. Claim Rejections under 35 U.S.C. § 112, second paragraph**

Claim 10 has been rejected under 35 U.S.C. 112, second paragraph as being indefinite for failing to define the metes and bounds of the claim. As noted above, claim 10 has been canceled by this amendment.

### **II. Claim Rejections under 35 U.S.C. § 103(a)**

Claims 1, 2, 4, 5, 7, 9-11, 13, 15 and 20 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Bonanno (US 6,431,055) in view of Cortese (US 6,584,888).

Claim 1, as amended, recites the feature of a brewing head comprising: a first hollow piston housed within said hollow containment structure movably relative thereto, wherein a first interstice is provided between the first piston and the hollow containment structure; a second piston housed within said first piston movably relative thereto, wherein a second interstice is provided between the first piston and the second piston; and wherein the first interstice and the

second interstice are both hydraulically connected to a fluid supply means provided for operating said first and second pistons by the direct action of a fluid under pressure.

Applicant respectfully submits that the combination of Bonanno and Cortese does not teach or suggest at least the above-noted features recited in amended claim 1.

With respect to Bonanno, Applicant notes that this reference discloses a brewing unit having a first piston 7 and a second piston 9, wherein the first piston 7 is movable within a hollow body 5, and the second piston 9 is placed within the first piston 7 (see Fig. 1 and col. 1, line 63 through col. 2, line 10).

As is evident from Fig. 1 of Bonanno, there is a single cavity 51 which can be filled with pressurized water via a conduit 52, wherein the cavity 51 is formed between the hollow body 5 and the first piston 7 (see col. 2, lines 1-3). In this regard, Applicant notes that while the first piston 7 is operated under the direct action of the pressurized water from the conduit 52, that the second piston 9 is moved indirectly by the pressurized water as a result of the movement of the first piston 7 and the presence of coffee powder within the brewing chamber 152 (see col. 2, lines 55-58).

Based on the foregoing description, Applicant notes that because Bonanno discloses only a single cavity that can be filled with pressurized water, and that the second piston 9 is moved indirectly by the pressurized water, that Bonanno does not disclose or suggest the above-noted features recited in amended claim 1 drawn to a first interstice provided between the first piston and the hollow containment structure, and a second interstice provided between the first piston and the second piston, wherein the first interstice and the second interstice are both hydraulically

connected to a fluid supply means provided for operating said first and second pistons by the direct action of a fluid under pressure. Further, Applicant respectfully submits that Cortese fails to cure these deficiencies of Bonanno.

In addition, Applicants note that claim 1 has also been amended to recite that the brewing head is movable relative to the rotatable base by means of a crank-connecting rod mechanism. Applicants respectfully submit that neither Bonanno nor Cortese disclose, suggest or otherwise render obvious such a feature.

In view of the foregoing, Applicant respectfully submits that the combination of Bonanno and Cortese does not teach, suggest or otherwise render obvious all of the features recited in amended claim 1. Accordingly, Applicant submits that claim 1 is patentable over the cited prior art, an indication of which is kindly requested.

Regarding claims 2, 4, 5, 7, 9, 11, 13, 15 and 20, Applicant notes that these claims depend from claim 1 and are therefore considered patentable at least by virtue of their dependency.

### **III. Allowable Subject Matter**

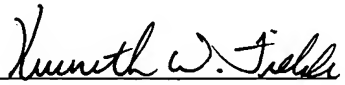
Applicant thanks the Examiner for indicating that claims 3, 6, 8, 12, 14 and 16-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims.

#### **IV. Conclusion**

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may best be resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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# **MECHANICALLY AND HYDRODYNAMICALLY OPERATED BREWING UNIT**

Version with Markings to  
Show Changes Made

## **FIELD OF THE INVENTION DESCRIPTION**

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The present invention refers to a mechanically and hydrodynamically operated brewing unit for automatic beverage vending machines, which is adapted to prepare the beverages to be dispensed starting from so-called capsules, preferably hermetically sealed ones, containing the raw material  
10 to be brewed.

## **BACKGROUND OF THE INVENTION**

In the course of the last few years, there has been a growing use, in automatic vending machines for preparing and dispensing beverages, of  
15 so-called capsules, in particular such capsules of a hermetically sealed type, which contain a raw material ready for brewing. These sealed capsules are constituted by semi-rigid envelopes provided with a collet, which create a physical barrier separating their contents from the surrounding ambient. In beverage vending machines, capsules of this kind  
20 are certainly by far preferable over both the traditional pre-filled filters, i.e. filters that are filled in advance with the raw material for brewing, and those capsules that are constituted by a semi-rigid envelope comprising a pair of surfaces acting as filtering elements, i.e. elements that enable the brew to pass therethrough, while retaining the raw material within the  
25 same capsule. The main advantage deriving from the afore-mentioned hermetically sealed capsules lies in the fact that the raw material contained in these capsules is effectively and reliably preserved from any contact with the outside ambient, thereby ensuring a maximum extent of hygiene, as well as an optimum preservation of the ~~flavour~~ flavor,  
30 fragrance and the other properties of the content thereof ~~also~~ over prolonged periods of time. This is basically why this kind of packaging is highly preferable, especially in those vending machines, which prepare

and dispense beverages of an aromatic kind, such as for instance coffee, tisanes or other kinds of hot infusions.

Largely known in the art is the fact that the use of sealed capsules in automatic vending machines requires these machines to be provided with brewing units that comprise devices adapted to accommodate and hold the capsules themselves, as well as devices adapted to ensure the watertightness of the brewing chamber and devices adapted to pierce the capsule in order to enable water to come into contact with the raw material contained therein. When a brewing unit of the just described kind is in operation, some of the members constituting the same unit are set in motion, so as to displace relative to each other, by means of appropriate mechanical devices that are usually operated by an electric motor. The fact that such brewing units are operated solely by mechanical members and devices is disadvantageous in that the operating accuracy of such mechanical members, and as a result the proper production of the beverage, are strongly dependent on the manufacturing and assembly tolerances of the various mechanical parts involved, as well as the increasing wear-down state of the materials which said mechanical parts are made of. To particularly suffer from this drawback is chiefly the mating accuracy of those elements constituting the brewing unit, which are temporarily associated with each other in order to tightly seal the brewing chamber during the beverage preparation process. It can be readily appreciated that, if such a mating accuracy is not perfect, or becomes imperfect after a certain number of working cycles of the brewing unit, there will occur leakage problems involving both liquid and raw material, which eventually affect the quality of the beverage being produced. Another device that is particularly affected by this drawback is ~~the one~~ that causes the capsule to be pierced. In prior-art brewing units, the piercing operation is performed with the aid of means that press the capsule against a device comprising one or more projections that are so shaped as to be able to pierce the material which the capsule is made of. Even in this case, it can be readily appreciated that if the pressing action

intervening between the capsule and the piercing device cannot be brought about to full intensity, i.e. loses some of its force due to the inaccuracy of the mechanical devices moving or actuating the various parts forming the brewing unit, the resulting beverage will not be  
5 produced correctly.

Known from the disclosure in ~~the~~ US patent No. 6,431,055 is a brewing unit for the preparation of espresso coffee, the component parts of which are actuated by the action of pressurized water from the machine pump  
10 without any further electric or pneumatic control being used. The brewing unit described in this patent publication is designed to work with the use of loose coffee powder or filter bags that are pre-filled with raw material, of the type of those provided in the form of a capsule constituted by a semi-rigid envelope with a base and a bottom acting as a filter. Further to the  
15 already mentioned poor preservation of the raw material contained in capsules provided with filtering surfaces, the brewing unit described in US 6,431,055 ~~6.431,055~~ can by no means operate by using the more advantageous capsules of the hermetically sealed type, since no device or member adapted to enable the capsules to be duly pierced is provided  
20 ~~there~~ therein.

### SUMMARY OF THE INVENTION

It therefore is the object of the present invention to provide a mechanically and hydrodynamically operated brewing unit for beverage  
25 vending machines, which is capable of carrying out the preparation of beverages with the aid of capsules, preferably hermetically sealed ones, containing the raw material to be brewed, while doing away with the drawbacks and disadvantages of prior-art brewing units of this kind.

30 Within this general object, it is a purpose of the present invention to provide a brewing unit, which is capable of operating effectively, although not limitatively, with capsules of the hermetically sealed type.

Another purpose of the present invention is to provide a brewing unit, the operation of which is fully independent of manufacturing and assembly tolerances of the various mechanical component parts, as well as of the progressing wear and tear of the materials which said component parts are made of, the brewing unit itself being so sized and designed as to be extremely compact and capable of being accommodated in a beverage vending machine of the usual kind.

#### BRIEF DESCRIPTION OF THE DRAWINGS

According to the present invention, these aims are reached in a capsule feeding apparatus for beverage vending machines incorporating the characteristics ~~as recited in the appended claim 1~~ described in a first aspect of the present invention. Features and advantages of the present invention will anyway be more readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

[[ - ]] Figure 1 is a cross-sectional view of the brewing unit in a phase of the operation thereof;

[[ - ]] Figure 2 is a cross-sectional view of the brewing unit shown in Figure 1, but in a second operating phase thereof;

[[ - ]] Figure 3 is a cross-sectional view of the brewing unit shown in Figure 1, but in a third operating phase thereof;

[[ - ]] Figure 4 is a cross-sectional view of the brewing unit shown in Figure 1, but in a fourth operating phase thereof; and

[[ - ]] Figure 5 is a cross-sectional view of the brewing unit shown in Figure 1, but in a fifth operating phase thereof.



## DETAILED DESCRIPTION OF THE INVENTION

Figure 1 illustrates a brewing unit 1 for automatic beverage vending machines, which is constituted by a box-like containment body 2 acting as an outer casing for the entire brewing unit 1, a base 3 and a brewing head 4. Within the box-like containment body 2, in addition further to the base 3 and the brewing head 4, there are also housed ~~also~~ the mechanical members that form a kinematic chain adapted to operate both the base 3 and the brewing head 4. In particular, these mechanical operating members include a crank 5, to which there is rotatably connected the first end portion of a connecting rod 6, the second end portion of the connecting rod 6 being connected to the brewing unit 4. Firmly joined to the crank 5 there is a cam 7, which interacts with the lower contour 8 of an ejection lever 9 provided with an upper contour 10 that controls the ejection of the capsule 11 from the base 3. In the crank 5 there are provided two recesses 12 adapted to be engaged by a detent lever 13 that is rotatably connected to the box-like containment body 2 and prevents the crank 5 from rotating to rotate in either one of the two possible directions of rotation during the beverage preparation phases. A movement of this detent lever 13 is opposed by a first spring 14, through which said detent lever 13 is connected further to the box-like containment body 2.

The base 3 of the brewing unit 1 is constituted by a hollow body that defines a compartment 15 accommodating the capsule 11, this compartment being open on top and comprising a bottom wall 16. The compartment 15 is adapted to act as the brewing chamber for the preparation of the beverage. Said bottom wall 16 is provided with a plurality of projections 17 that are so shaped as to be able to pierce the material forming the capsule 11. Each one of said projections 17 comprises an opening enabling the beverage to flow out towards means 18 connecting the brewing chamber to the beverage dispensing point. The bottom wall 16 is made in such a manner as to be capable of serving as a filter during the outflow of the beverage from the brewing chamber.

Within the hollow body of said base 3, and along the longitudinal axis thereof, there is slidably mounted a bar 19 that causes the capsule to be ejected from the compartment 15 in which it is accommodated. This bar 19 comprises a first end portion 20 in contact with the upper contour 10 of the ejection lever 9, and a second end portion 21 that faces into the compartment 15 at the bottom wall 16 thereof. The movement of this bar 19 is opposed by a second spring 26 connected to the base 3.

The base 3 is rotatably mounted onto the box-like containment body 2 and comprises a pin 22 engaging a first guiding profile 23 that is firmly joined to the connecting rod 6 and suitably sized and shaped so as to coordinate the movement of the base 3 with the movement of the brewing head 4 and, in particular, to bring about a rotation of the base 3 when the connecting rod 6 and, as a result, also the brewing head 4 are displaced ~~due~~ owing to the movement of the crank 5. The base 3 is capable of moving between a first position, in which the capsule 11 is loaded into the receiving compartment 15, and a second position, in which the beverage is brewed. Said first position is such that the compartment 15 is moved to a position in which it is facing the outlet aperture of a feeding conveyor 24 designed to dispense the capsules being stored in a proper reservoir (not shown). Said second position, on the ~~contrary~~ other hand, is such that the receiving compartment 15 is moved into a position in which it is facing the brewing head 4. In order to ensure that the base 3 will correctly and accurately stop at the above-described end positions thereof, the pin 22 is designed to further engage a second curvilinear guiding profile 25.

The brewing head 4, which forms a hydrodynamic actuation unit, comprises a hollow containment structure 27, in which there is mounted in a tightly sealed manner a first hollow piston 28 that is movable relative to the same structure 27. Within this first piston 28 there is mounted, again in a tightly sealed manner, a second piston 29 that is movable relative to said first piston 28, the movement of this second piston being

opposed by elastic means 30 connected to the hollow containment structure 27. The second piston 29 extends along the longitudinal axis thereof so as to form a hollow interspace 33, which is associated to means 32 for letting pressurized water into the compartment 15 acting as a brewing chamber. The second piston 29 is provided with a circumferential edge that is so shaped and made as to be able to pierce the material forming the capsule 11 when an appropriate pressure is exerted on the capsule 11 by the same piston 29. The bottom surface 31 of the second piston 29 comprises a plurality of apertures (not shown in Figure 1) that are provided in order to enable the water to enter the compartment 15.

To the containment structure 27 there is connected a conduit 34 within which there moves a fluid under pressure, which in this way directly controls the movement of the first and the second piston 28 and 29. This movement of said pistons is practically imparted by said fluid under pressure being injected into or extracted from the interstices comprised between the containment structure 27 and the first piston 28, as well as the interstices comprised between the first piston 28 ~~latter~~ and the second piston 29. The above-mentioned fluid may be in its liquid state or in its gaseous state, but is preferably constituted by the water flowing in from the same source used to produce the beverage. The fluid itself is put under pressure by an appropriate apparatus, such as for instance a pump or a compressor.

The direction of the relative displacement of the second piston 29 with respect to the first piston 28 is determined by the direction of the force resulting between the action of said elastic means 30 and said direct action of the fluid under pressure; in particular, the movement of the second piston 29 starts when the pushing force exerted thereunto by the fluid under pressure exceeds the biasing force of the elastic means 30. Should for any reason whatsoever an overpressure condition occur within the above-mentioned interstices, the pressurized fluid is allowed to flow

out through a safety bleeder 35 so as to collect into a reservoir (not shown).

Accordingly, the way in which the unit according to the present  
5 invention operates is as follows.

With reference to Figures 1 and 2, after the capsule 11 coming from the feeding conveyor 25 has occupied the receiving compartment 15, the rotation of the crank 5 and the associated cam 7 in the direction indicated  
10 by the arrow F causes the base 3 to ~~also~~ rotate and the brewing head 4 to descend along the first guiding profile 23. The travelling length of the brewing head 4 is so sized and designed as to ensure that the brewing head itself is able to move all along until it comes quite close to the base 3, however without coming into contact therewith (Figure 2). When the  
15 brewing head 4 has covered the entire allowable travelling length thereof, the detent lever 13 slides into and engages one of the recesses 12 so as to prevent the brewing head 4 from possibly moving away from the base 3 accidentally. At this point, as ~~this is~~ best shown in Figure 3, a fluid under pressure is injected through the conduit 34 into the interstices comprised  
20 between the containment structure 27 and the first piston 28, thereby bring about a displacement of said structure 27 and said first piston 28 relative to each other, this relative movement continuing until said first piston 28 eventually comes into contact with the base 3 and the capsule 11. The pushing action exerted by the fluid under pressure contributes to  
25 the compartment 15 being at this point closed and sealed hermetically, so that it can now act as the brewing chamber. As the fluid under pressure keeps being injected through the conduit 34 (Figure 4), the same fluid eventually fills up ~~also~~ those interstices that are comprised between the first piston 28 and the second piston 29, thereby overcoming the  
30 contrasting action exerted by the elastic means 30. The second piston 29 slides relative to the first piston 28 and moves to occupy a portion of the compartment 15 with the bottom surface 31 thereof. In this way, the circumferential edge of the second piston 29, as it is pressed against the

capsule 11 by the action of the fluid under pressure, pierces the upper surface thereof, while the piston's bottom surface 31 urges the same capsule 11 towards the bottom wall 16 of the base 3, thereby causing the capsule itself to be further pierced by the projections 17.

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Upon the capsule 11 having been so pierced, and as the fluid under pressure keeps being present in the conduit 34, water under pressure is let into the compartment 15 via the means 32 connected to the hollow interspace 33. This pressurized water comes into contact with the raw  
10 material contained in the capsule 11, thereby forming a beverage that is capable of flowing out of the compartment 15 through the apertures provided in the projections 17, and running towards the connecting means 18 to the dispensing point.

15 Then, when the desired amount of water under pressure has flown through the capsule 11 and left the compartment 15, i.e. when the desired dose of beverage is reached, the process for ejecting the exhausted capsule 11 is started. In the position in which the base 3 and the brewing head 4 are lying at this point, i.e. the position in which the brewing head 4 is  
20 engaging the base 3, as illustrated in Figure 4, while the fluid in the conduit 34 continues being kept under pressure, the water still present within the capsule 11 is removed by sucking it up through the means 32, thereby preventing the water and raw material mixture still remaining in the capsule 11 from being able to spill out from the capsule and soil the  
25 brewing unit 1. Next, the fluid under pressure is extracted through the conduit 34 from the interstices between the first piston 28 and the second piston 29, as well as those between the containment structure 27 and the first piston 28, so that said pistons are able to slide backwards, thereby retracting into the containment structure 27 and making in this way the  
30 base 3 independent of the brewing head 4.

Upon such retraction having been so completed, the crank 5 and the cam 7 firmly associated therewith are operated again to rotate in the

direction indicated by the arrow F (Figure 5), thereby causing the base 3 to rotate accordingly and, at the same time, the brewing head 4 to move away from the base 3 along the first guiding profile 23. During the rotation of the crank 5, and prior to the base 3 completing its movement, the cam 7 comes into contact with the lower contour 8 of the ejection lever 9, which, via the upper contour 10 thereof, actuates the bar 19 so as to cause it to enter the compartment 15, thereby causing the capsule 11 to be ejected from the base 3. The action of this bar is most clearly illustrated in Figure 5. Upon conclusion of the rotation of the crank 5, the base 3 comes to lie in a position in which it faces the outlet aperture of the feeding conveyor 24, whereas the brewing head 4 moves back into the resting position thereof, as illustrated in Figure 1. At this point, the brewing unit 1 is ready to start a new cycle for producing another beverage.

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Fully apparent from the above description is therefore the ability of the the present invention to effectively reach the afore cited aims and advantages by providing a brewing unit that is capable of operating effectively, although not limitatively, with capsules of the hermetically sealed type. Moreover, it is fully ~~Fully apparent is moreover the fact that~~ the operation of the brewing unit of the present invention, due thanks to the use of its comprising a hydrodynamic actuating system, is fully independent of manufacturing and assembly tolerances of the various mechanical component parts, as well as of the progressing wear and tear of the materials which said component parts are made of, the brewing unit itself being so sized and designed as to be extremely compact and capable of being accommodated in a beverage vending machine of the usual kind.

It should be noticed that the materials used, as well as the shapes and the sizing of the individual items, may each time be selected so as to more appropriately meet the particular requirements or suit the particular application, without departing from the scope of the present invention.

The various component parts entering the construction of the brewing unit according to the present invention shall certainly not be provided solely in the afore illustrated embodiments, but may rather be used or implemented in a number of different embodiments, again without  
5 departing from the scope of the present invention.

## ABSTRACT

A ~~The invention relates to a~~ mechanically and hydrodynamically operated brewing unit (1) for automatic beverage vending machines,   
5 ~~comprising includes~~ a rotatable base (3) provided with a compartment (15) that acts as a brewing chamber, means to let water under pressure into said compartment, means to connect said compartment with the point at which the brewed beverage is dispensed, and a brewing head (4). This brewing head is comprised of a hollow containment structure-~~(279~~ (279), a   
10 first hollow piston (28) that is housed in said containment structure movably relative thereto, a second piston (29) that is accommodated in said first piston movably relative thereto, and elastic means (30) contrasting the movement of said second piston. The brewing unit is characterized in that said first piston and said second piston are operated   
15 by the direct action of a fluid under pressure.